Claims

1. A method of controlling a data packet flow in a buffer means (13; 14) of a network node of a data network, said method comprising the steps of:
   a) assigning a nominal capacity to each data flow; and
   b) shifting free capacity from a first flow portion to a second flow portion, when a new data packet of said second flow portion has been received at said buffer means (13, 14) and said nominal capacity has been exceeded.

2. A method according to claim 1, wherein said nominal capacity is an upper buffer memory limit of a buffer memory (13) of said buffer means shared between a plurality of channels allocated to respective packet data connections and determined in dependence on the number of allocated channels, and wherein memory space is shifted from said first channel to a second channel, when a new data packet of said second channel has been received and not enough memory space is available for said second channel.

3. A method according to claim 2, wherein said upper buffer memory limit is determined by dividing the total buffer memory capacity by the number of allocated channels.

4. A method according to claim 2 or 3, wherein said second channel is a new channel set up for a new packet data connection.

5. A method according to claim 2 or 3, wherein said second channel is a channel having reached its upper buffer memory limit.

6. A method according to any one of claims 2 to 5, wherein a channel with the longest packet queue is selected as said first channel, and a predetermined data packet is dropped from the queue of said first channel, when no free memory is available in said buffer memory (13).

7. A method according to claim 6, wherein said predetermined data packet is located at the front of the queue of said first channel.

8. A method according to claim 6 or 7, wherein said dropping of said predetermined data packet is inhibited and said new data packet is dropped, if the queue of said second channel has reached said upper buffer memory limit.

9. A method according to any one of claims 6 to 8, wherein said channel with the longest packet queue is determined by an estimation.

10. A method according to claim 9, wherein said estimation is performed by storing the length and identity of the last determined longest queue, comparing the length of a current queue with said stored longest queue on a queuing event, and updating the length and identity of said stored longest queue according to the result of comparison.

11. A method according to any one of the preceding claims, wherein said buffer means is a PDCP buffer (13).

12. A method according to any one of the preceding claims, wherein said packet data connections are connections between mobile terminals (MT1 - MTn) and Internet hosts (H1 - Hn), or between mobile terminals.

13. A method according to claim 1, wherein said nominal capacity is a nominal flow rate at which data flow traffic is guaranteed.

14. A method according to claim 13, wherein said free capacity is a residual rate corresponding to the difference between said nominal flow rate and an instantaneous traffic rate of said first flow portion.

15. A method according to any one of claims 13 to 14, further comprising the step of admitting a new data flow only if the nominal flow rate of said new data flow falls within the remaining system bandwidth.

16. A method according to claim 15, wherein said remaining system bandwidth is decremented by said nominal flow rate if said new data flow is admitted.

17. A method according to any one of claims 13 to 16, wherein said method is used in a QoS scheduling algorithm for scheduling concurrent user traffic.

18. A method according to claim 17, wherein said QoS scheduling algorithm is adapted to operate on a round basis, and wherein multiple users can be served at one round and/or a user data flow can be served with more than one data packet at one round.

19. A method according to claim 18, wherein said round corresponds to one or more WCDMA radio frames or one or more EDGE TDMA frames.

20. A method according to claim 18 or 19, wherein said first and second flow portions belong to different data flows scheduled on the same round.

21. A method according to claim 18 or 19, wherein said first and second flow portions belong to the same data flow, and said first flow portion is scheduled on a round following the round of said second flow portion.

22. A method according to claim 18 or 19, wherein said first and second flow portions belong to different data flows, and said first flow portion is scheduled on a round following the round of said second flow portion.

23. A method according to any one of claims 13 to 22, wherein said nominal flow rate is determined based on the following equation:

$$NR_i = \alpha \times Cr_i$$

wherein α denotes a fractional value defining a tradeoff between an overall packet loss ratio and a system throughput, NR_i denotes a nominal flow rate assigned to a concerned user data flow i, and CR_i denotes a contracted data rate for said concerned user data flow i.

24. A method according to any one of claims 13 to 23, wherein an urgency factor is assigned to each data packet, and the target flow for said shift of said free capacity is determined based on said urgency factor.

25. A method according to any one of claims 13 to 23, wherein an accumulated residual bandwidth is determined for each data flow, and the target flow for said shift of said free capacity is determined based on said accumulated residual bandwidth.

26. A method according to any one of claims 13 to 25, wherein arriving data packets are segmented into data segments and scheduling is performed at the data segment level.

27. A network node for controlling a data packet flow in a buffer means (13; 14) of said network node, wherein said network node comprises flow control means (11; 14) for assigning a nominal capacity to each data flow, and for shifting free capacity from a first flow portion to a second flow portion when a new data packet of said second flow portion has been received at said buffer means (13; 14) and said nominal capacity has been exceeded.

28. A network node according to claim 27, wherein said buffer means comprises a buffer memory (13) shared between a plurality of channels allocated to respective packet data connections; and said flow control means comprises buffer control means (11) for determining an upper buffer memory limit for each channel in dependence on the number of allocated packet data connections, and for controlling allocating means (12) so as to shift memory space allocated to a first channel from said first channel to a second channel, when a new data packet of said second channel has been received and not enough memory space is available for said second channel.

29. A network node according to claim 28, wherein said buffer control means (11) is arranged to determine said upper buffer memory limit by dividing the total buffer memory capacity by the number of allocated channels.

30. A network node according to claim 28 or 29, wherein said buffer control means (11) is arranged to select a channel with the longest packet queue as said first channel and to control said allocating means (12) so as to drop a predetermined data packet from the queue of said first channel when no free memory is available in said buffer memory (13).

31. A network node according to claim 30, wherein said buffer control means (11) is arranged to inhibit said dropping of said predetermined packet and to control said allocating means (12) to drop said new data packet, if the queue of said second channel has reached said upper buffer memory limit.

32. A network node according to claim 30 or 31, wherein said buffer control means (11) is arranged to estimate said channel with the longest packet

queue by storing the length and identity of the last determined longest queue, to compare the length of a current queue with said stored longest queue on a queuing event, and to update the length and identity of said stored longest queue according to the result of comparison.

33. A network node according to any one of claims 28 to 32, wherein said buffer memory is a PDCP buffer (13).

34. A network node according to claim 27, wherein said flow control means comprises scheduling means (14) and said nominal capacity is a nominal flow rate at which data flow traffic is guaranteed in a QoS scheduling algorithm.

35. A network node according to claim 34, wherein said scheduling means (14) comprises said buffer means.

36. A network node according to any one of claims 27 to 35, wherein said network node is a radio network controller (10).